Gunter, Jason

From: James, Kevin <kjames@doerun.com>
Sent: Monday, November 10, 2014 7:41 PM
To: Gunter, Jason
Cc: Yingling, Mark; Neaville, Chris; Montgomery, Michael; 'robert.hinkson@dnr.mo.gov'; 'brandon.wiles@dnr.mo.gov'; 'Ty Morris (TMorris@barr.com)'; Nations, Mark
Subject: Rivermines Progress Report - October
Attachments: removed.txt; RiverMines_October2014.pdf; Remediation Air Report with 3rdQ Audit - September 2014.pdf; 2014-10-29 RM NPDES Pace Lab Report.pdf

Categories: Red Category

Jason -

Attached is the October Progress Report for the Rivermines Site.

Upon further review of last month's submission, please note that the email header was incorrectly labeled "August" instead of the correct reporting month of "September". The attachments were correctly identified as September.

Best regards,

Kevin James on behalf of Mark Nations

Kevin James
Environmental Engineering
W: 573.626.2096
C: 573.247.6766

THE DOE RUN COMPANY

Remediation Group

Mark Nations
Mining Properties Manager
mnations@doerun.com

November 10, 2014

Mr. Jason Gunter
Remedial Project Manager
U.S. Environmental Protection Agency
Region 7 - Superfund Branch
11201 Renner Blvd.
Lenexa, KS 66219

Re: The Doe Run Company – Elvins/Rivermines Mine Tailings Site Monthly Progress Report

Dear Mr. Gunter:

As required by Article VI, Section 56 of the Unilateral Administrative Order (UAO) (CERCLA-07-2005-0169) for the referenced project and on behalf of The Doe Run Company, the progress report for the period October 1, 2014 through October 31, 2014 is enclosed. If you have any questions or comments, please call me at 573-518-0800.

Sincerely,

Mark Nations
Mining Properties Manager

Enclosures
c: Mark Yingling – TDRC (electronic only)
Kevin James – TDRC (electronic only)
Chris Neaville – TDRC (electronic only)
Michael Montgomery – TDRC (electronic only)
Robert Hinkson – MDNR
Brandon Wiles – MDNR
Ty Morris – Barr Engineering

Elvins/Rivermines Mine Tailings Site
Park Hills, Missouri
Removal Action - Monthly Progress Report
Period: October 1, 2014 – October 31, 2014

1. **Actions Performed and Problems Encountered This Period:**
   a. During this period, flow from the seepage pond was directed through the roughing filter, the iron filter, and then into the round tank, where it discharged directly into the effluent channel.
   b. Continued to take analytical samples from the western treatment pond effluent to monitor the metals reduction of the treatment pond.
   c. Flow to the east treatment cell remained off throughout this period.
   d. Work continued on the development of the Post-Removal Site Control Plan for the site.
   e. A draft of the surface water management plan was submitted for review and comment to the U.S. Environmental Protection Agency (EPA) and Missouri Department of Natural Resources (MDNR) on October 10, 2014.
   f. On October 28, 2014 EPA and MDNR responded to the draft surface water management plan. Work has begun to address the comments received.

2. **Analytical Data and Results Received This Period:**
   a. During this period, water samples were collected from just upstream of Old Missouri Highway 32, as well as from upstream and downstream of the confluence of the site discharge with Flat River. The analytical results for this event are included with this progress report.
   b. During this period, the ambient air monitoring samples for September were processed and the Ambient Air Monitoring Report for September 2014 was completed. A copy of the Ambient Air Monitoring Report for September is attached.

3. **Developments Anticipated and Work Scheduled for Next Period:**
   a. Complete monthly water sampling activities as described in the Removal Action Work Plan.
   b. Complete air monitoring activities as described in the Removal Action Work Plan.
   c. Continue developing the Post-Removal Site Control Plan.
   d. Respond to comments on the surface water management plan for the site.

4. **Changes in Personnel:**
   a. None.

5. **Issues or Problems Arising This Period:**
   a. None.

6. **Resolution of Issues or Problems Arising This Period:**
   a. None.

Monthly Ambient Air Monitoring Report

The Doe Run Company
Old Lead Belt Sites:
Federal, Rivermines, National, and Leadwood

September-2014

THE DOE RUN COMPANY

SUITE 300
1801 PARK 270 DRIVE
ST. LOUIS, MO 63146

Federal Site

Sample Results for **September-2014**

	St. Joe (Ballfields)		Big River#4		Water Treatment Plant	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
9/2/14	22	0.007	14	0.007	27	0.042
9/3/14	26	0.007	20	0.014	19	0.007
9/4/14	31	0.007	25	0.014	27	0.007
9/5/14	17	0.007	19	0.007	17	0.035
9/8/14	27	0.007	20	0.007	16	0.007
9/9/14	40	0.021	28	0.007	29	0.007
9/10/14	11	0.000	7	0.000	11	0.000
9/11/14	8	0.007	7	0.007	5	0.000
9/12/14	7	0.007	6	0.000	7	0.007
9/15/14	15	0.007	10	0.007	9	0.014
9/16/14	17	0.007	15	0.007	12	0.007
9/17/14	16	0.007	13	0.007	8	0.007
9/18/14	22	0.007	20	0.007	16	0.014
9/19/14	23	0.007	17	0.007	17	0.021
9/22/14	21	0.014	20	0.013	19	0.020
9/23/14	18	0.014	21	0.013	24	0.068
9/24/14	21	0.007	24	0.027	17	0.014
9/25/14	28	0.014	26	0.014	25	0.014
9/26/14	28	0.007	34	0.013	29	0.007
9/29/14	28	0.014	37	0.020	33	0.021
9/30/14	27	0.014	32	0.088	36	0.049

Monthly Avg. TSP	22	20	19
Monthly Avg. Pb	0.009	0.013	0.017
Aug-14	0.014	0.019	0.024
Jul-14	0.015	0.023	0.028
Rolling 3-Month	**0.012**	**0.019**	**0.023**

Three month rolling average must be less than 0.15 ug/m3

NOTES:

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007
9/4/14	25	0.021
9/9/14	30	0.007
9/11/14	6	0.007
9/16/14	14	0.007
9/18/14	18	0.007
9/23/14	22	0.014
9/25/14	28	0.014
9/30/14	32	0.021

Rivermines

Sample Results for **September-2014**

	Big River #4		Rivermines South #1		Rivermines North #2		Rivermines East #3	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007	18	0.048	13	0.014	27	0.042
9/3/14	20	0.014	16	0.007	27	0.105	19	0.007
9/4/14	25	0.014	22	0.007	23	0.042	27	0.007
9/5/14	19	0.007	invalid	invalid	15	0.014	17	0.035
9/8/14	20	0.007	21	0.007	15	0.007	16	0.007
9/9/14	28	0.007	24	0.007	29	0.042	29	0.007
9/10/14	7	0.000	47	0.222	10	0.007	11	0.000
9/11/14	7	0.007	13	0.074	23	0.000	5	0.000
9/12/14	6	0.000	4	0.013	2	0.000	7	0.007
9/15/14	10	0.007	10	0.020	13	0.028	9	0.014
9/16/14	15	0.007	19	0.027	14	0.007	12	0.007
9/17/14	13	0.007	8	0.007	11	0.007	8	0.007
9/18/14	20	0.007	25	0.020	19	0.035	16	0.014
9/19/14	17	0.007	15	0.020	16	0.021	17	0.021
9/22/14	20	0.013	36	0.099	16	0.014	19	0.020
9/23/14	21	0.013	58	0.215	24	0.109	24	0.068
9/24/14	24	0.027	22	0.040	21	0.048	17	0.014
9/25/14	26	0.014	28	0.027	26	0.028	25	0.014
9/26/14	34	0.013	34	0.019	29	0.007	29	0.007
9/29/14	37	0.020	44	0.102	47	0.112	33	0.021
9/30/14	32	0.088	39	0.047	30	0.021	36	0.049

Monthly Avg. TSP	20	25	20	19
Monthly Avg. Pb	0.013	0.051	0.032	0.017
Aug-14	0.019	0.087	0.043	0.024
Jul-14	0.023	0.112	0.029	0.028
Rolling 3-Month	**0.019**	**0.083**	**0.035**	**0.023**

Three month rolling average must be less than 0.15 ug/m3

NOTES: Rivermines South - 9/5: <23hr run time

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007
9/4/14	25	0.021
9/9/14	30	0.007
9/11/14	6	0.007
9/16/14	14	0.007
9/18/14	18	0.007
9/23/14	22	0.014
9/25/14	28	0.014
9/30/14	32	0.021

National Site

Sample Results for **September-2014**

	Big River #4		Ozark #1		Soccer Park #2		Water Treatment Plant	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007	23	0.007	15	0.007	27	0.042
9/3/14	20	0.014	24	0.007	25	0.014	19	0.007
9/4/14	25	0.014	38	0.021	29	0.014	27	0.007
9/5/14	19	0.007	14	0.007	16	0.007	17	0.035
9/8/14	20	0.007	20	0.007	32	0.021	16	0.007
9/9/14	28	0.007	34	0.007	103	0.035	29	0.007
9/10/14	7	0.000	10	0.000	12	0.007	11	0.000
9/11/14	7	0.007	4	0.000	4	0.000	5	0.000
9/12/14	6	0.000	2	0.000	4	0.007	7	0.007
9/15/14	10	0.007	11	0.007	9	0.007	9	0.014
9/16/14	15	0.007	13	0.007	14	0.007	12	0.007
9/17/14	13	0.007	10	0.007	24	0.021	8	0.007
9/18/14	20	0.007	17	0.007	25	0.021	16	0.014
9/19/14	17	0.007	20	0.014	25	0.021	17	0.021
9/22/14	20	0.013	25	0.014	23	0.020	19	0.020
9/23/14	21	0.013	28	0.020	28	0.034	24	0.068
9/24/14	24	0.027	43	0.014	24	0.014	17	0.014
9/25/14	26	0.014	35	0.014	38	0.027	25	0.014
9/26/14	34	0.013	31	0.007	47	0.014	29	0.007
9/29/14	37	0.020	41	0.021	39	0.021	33	0.021
9/30/14	32	0.088	21	0.007	36	0.021	36	0.049

Monthly Avg. TSP	20	22	27	19
Monthly Avg. Pb	0.013	0.009	0.016	0.017
Aug-14	0.019	0.012	0.015	0.024
Jul-14	0.023	0.009	0.014	0.028
Rolling 3-Month	**0.019**	**0.010**	**0.015**	**0.023**

Three month rolling average must be less than 0.15 ug/m3

NOTES:

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007
9/4/14	25	0.021
9/9/14	30	0.007
9/11/14	6	0.007
9/16/14	14	0.007
9/18/14	18	0.007
9/23/14	22	0.014
9/25/14	28	0.014
9/30/14	32	0.021

Leadwood

Sample Results for **September-2014**

	Big River #4		Leadwood South #1		Leadwood East #2		Leadwood North #3	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007	14	0.007	12	0.007	10	0.000
9/3/14	20	0.014	invalid	invalid	27	0.034	16	0.014
9/4/14	25	0.014	29	0.007	78	0.055	24	0.000
9/5/14	19	0.007	20	0.007	21	0.007	15	0.000
9/8/14	20	0.007	29	0.007	28	0.027	18	0.007
9/9/14	28	0.007	37	0.007	83	0.061	25	0.000
9/10/14	7	0.000	17	0.000	12	0.000	15	0.000
9/11/14	7	0.007	5	0.007	3	0.000	4	0.000
9/12/14	6	0.000	4	0.007	2	0.000	5	0.000
9/15/14	10	0.007	15	0.014	27	0.014	9	0.007
9/16/14	15	0.007	20	0.013	25	0.020	11	0.007
9/17/14	13	0.007	15	0.013	14	0.007	10	0.007
9/18/14	20	0.007	23	0.014	24	0.014	24	0.007
9/19/14	17	0.007	21	0.013	20	0.013	14	0.007
9/22/14	20	0.013	28	0.026	29	0.020	15	0.007
9/23/14	21	0.013	24	0.013	34	0.047	19	0.014
9/24/14	24	0.027	71	0.047	45	0.089	10	0.014
9/25/14	26	0.014	54	0.040	35	0.020	19	0.007
9/26/14	34	0.013	45	0.020	40	0.013	32	0.007
9/29/14	37	0.020	116	0.068	55	0.021	27	0.014
9/30/14	32	0.088	60	0.054	63	0.082	22	0.007

Monthly Avg. TSP	20	32	32	16
Monthly Avg. Pb	0.013	0.019	0.026	0.006
Aug-14	0.019	0.020	0.026	0.004
Jul-14	0.023	0.025	0.028	0.004
Rolling 3-Month	**0.019**	**0.021**	**0.026**	**0.005**

Three month rolling average must be less than 0.15 ug/m3

NOTES: Leadwood South - 9/3: <23hr run time

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007
9/4/14	25	0.021
9/9/14	30	0.007
9/11/14	6	0.007
9/16/14	14	0.007
9/18/14	18	0.007
9/23/14	22	0.014
9/25/14	28	0.014
9/30/14	32	0.021

Federal Site

Sample Results for **September-2014**

Sample Date	St. Joe (Ballfields) **PM10** (ug/m3)	Big River#4 **PM10** (ug/m3)	Water Treatment **PM10** (ug/m3)
9/2/14	14	16	15
9/5/14	20	18	18
9/8/14	19	21	22
9/11/14	3	6	9
9/14/14	6	9	11
9/17/14	15	19	15
9/20/14	15	15	14
9/23/14	12	10	13
9/26/14	21	23	25
9/29/14	24	23	28

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	15	16	17

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
9/2/14	15
9/8/14	9
9/14/14	6
9/20/14	15
9/26/14	16

Rivermines

Sample Results for **September-2014**

Sample Date	Big River #4 **PM10** (ug/m3)	Rivermines South #1 **PM10** (ug/m3)	Rivermines North #2 **PM10** (ug/m3)	Rivermines East #3 **PM10** (ug/m3)
9/2/14	16	11	15	15
9/5/14	18	13	9	18
9/8/14	21	17	20	22
9/11/14	6	32	invalid	9
9/14/14	9	10	5	11
9/17/14	19	12	15	15
9/20/14	15	15	14	14
9/23/14	10	14	12	13
9/26/14	23	23	17	25
9/29/14	23	25	30	28

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	16	17	15	17

NOTES: Rivermines North - 9/11: <23hr run time, vandalism, unplugged

Sample Date	Big River QA **PM10** (ug/m3)
9/2/14	15
9/8/14	9
9/14/14	6
9/20/14	15
9/26/14	16

National Site

Sample Results for **September-2014**

Sample Date	Big River #4 **PM10** (ug/m3)	Ozark #1 **PM10** (ug/m3)	Soccer Park #2 **PM10** (ug/m3)	Water Treatment **PM10** (ug/m3)
9/2/14	16	9	13	15
9/5/14	18	19	17	18
9/8/14	21	14	25	22
9/11/14	6	3	4	9
9/14/14	9	4	5	11
9/17/14	19	13	14	15
9/20/14	15	10	15	14
9/23/14	10	8	14	13
9/26/14	23	21	24	25
9/29/14	23	24	24	28

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	16	12	16	17

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
9/2/14	15
9/8/14	9
9/14/14	6
9/20/14	15
9/26/14	16

Leadwood

Sample Results for **September-2014**

Sample Date	Big River #4 **PM10** (ug/m3)	Leadwood South #1 **PM10** (ug/m3)	Leadwood East #2 **PM10** (ug/m3)	Leadwood North #3 **PM10** (ug/m3)
9/2/14	16	12	13	12
9/5/14	18	13	13	10
9/8/14	21	19	33	15
9/11/14	6	3	8	3
9/14/14	9	9	8	9
9/17/14	19	17	17	10
9/20/14	15	17	16	11
9/23/14	10	13	17	15
9/26/14	23	24	22	20
9/29/14	23	28	30	20

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	16	15	18	12

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
9/2/14	15
9/8/14	9
9/14/14	6
9/20/14	15
9/26/14	16

Meterological Data - Old Lead Belt
September-2014

24hr average

Date	Wind Speed (MPH)	Wind Direction	Sigma-Theta	Temperature (C)	Air Pressure (mmHg)	Rain (Inches)	Power Supply (Volts)
01-Sep-14	4.723	207.7	26.55	25.17	742	0.03	13.2
02-Sep-14	2.024	249.5	35.52	22.88	744	0.16	13.22
03-Sep-14	2.703	189.4	33.28	23.93	745	0.01	13.21
04-Sep-14	3.759	202	30.01	27.56	744	0.25	13.16
05-Sep-14	2.674	211.8	39.36	26.75	746	1.7	13.16
06-Sep-14	4.098	336.6	22.33	18.08	748	0	13.26
07-Sep-14	2.16	88.8	25.94	17.22	749	0	13.28
08-Sep-14	2.369	161.7	31.16	20.25	746	0	13.26
09-Sep-14	4.099	174.5	26.81	24.89	743	0	13.22
10-Sep-14	6.19	215.5	24.02	25.5	739	0.26	13.21
11-Sep-14	5.303	0.892	23.12	16	747	0.03	13.31
12-Sep-14	4.799	0.839	22.86	12.06	750	0.01	13.4
13-Sep-14	4.184	12.75	27.79	11.35	753	0	13.37
14-Sep-14	1.315	173.1	41.59	13.26	750	0	13.36
15-Sep-14	3.206	289.5	32.19	18.84	747	0.03	13.3
16-Sep-14	2.734	31.6	29.44	16.17	749	0	13.31
17-Sep-14	2.407	152.9	32.22	13.91	745	0.02	13.38
18-Sep-14	2.005	64.58	31.44	17.93	745	0	13.3
19-Sep-14	1.846	160.1	27.59	18.23	745	0	13.29
20-Sep-14	1.933	221.6	26.49	21.94	745	0	13.25
21-Sep-14	4.462	319.8	25.69	20.5	745	0	13.23
22-Sep-14	2.194	192.5	27.95	14.51	751	0	13.31
23-Sep-14	1.825	152.9	31.56	14.21	751	0	13.33
24-Sep-14	1.985	156.2	31.16	16.33	750	0	13.32
25-Sep-14	1.502	204.2	32.87	19.59	749	0	13.26
26-Sep-14	1.743	165.5	32.26	19.91	749	0	13.25
27-Sep-14	1.825	166	27.23	19.41	748	0	13.27
28-Sep-14	1.83	209.3	30.32	19.46	747	0	13.26
29-Sep-14	2.014	218.1	30.7	19.75	745	0	13.25
30-Sep-14	1.615	199.6	33.15	19.75	743	0	13.25

INQUEST
ENVIRONMENTAL INC.

3609 Mojave Ct., Ste E ◆ COLUMBIA, MO 65202
(573) 474-8110 ◆ FAX: (573) 474-8371

July 21, 2014

Mr. Greg Henson
Chemist
The Doe Run Company
881 Main Street
Herculaneum, MO 63048

RE: 3rd Quarter 2014 Park Hills Network Lead/PM10 Samplers Flow Rate Verifications Performance Audit Report.

Dear Mr. Henson,

Please find enclosed the worksheets detailing the Lead/PM10 sampler's one-point flow verifications that were recently performed on the Doe Run Park Hills Monitoring Network. A copy of the current certification for the audit device that was used has also been enclosed.

All of the flow rate verification checks of the samplers were found to be within guidelines.

After reviewing the enclosed information, please feel free to call with any comments or questions. Thank you for your business.

Sincerely,

John A. Kunkel
Inquest Environmental, Inc.

PM10 Sampler Flow Rate Verifications

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 Primary PM10	Temperature	20.0 °C 293.2 °K
Flow Controller	P2952	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.072	24.50	45.76	0.940	1.128	**5.22**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.20	45.20	0.941	1.129	1.070	**-5.31**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 QA PM10	Temperature	20.0 °C 293.2 °K
Flow Controller	P1019	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.30	1.089	25.20	47.06	0.938	1.139	**4.59**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
25.10	46.88	0.939	1.140	1.088	**-3.72**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.03497		
Station	National - Ozark Insulation	Intercept (Qa)	-0.00227		
Sampler	#1 PM10	Temperature	20.3 °C	293.5	°K
Flow Controller	P2950	Station Pressure	30.11 "Hg	764.8	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.073	24.00	44.82	0.941	1.127	**5.03**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.30	45.38	0.941	1.127	1.070	**-5.31**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 PM10	Temperature	21.4 °C 294.6 °K
Flow Controller	P4353	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.075	24.50	45.76	0.940	1.120	**4.19**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.30	45.38	0.941	1.121	1.074	**-4.96**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.03497		
Station	National - Crane Street	Intercept (Qa)	-0.00227		
Sampler	#2 PM10	Temperature	21.4 °C	294.6	°K
Flow Controller	P2949	Station Pressure	30.10 "Hg	764.5	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.075	24.00	44.82	0.941	1.128	**4.93**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.10	45.01	0.941	1.128	1.072	**-5.13**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Water Plant	Intercept (Qa)	-0.00227
Sampler	#3 PM10	Temperature	21.8 °C 295.0 °K
Flow Controller	P2951	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.076	23.70	44.26	0.942	1.135	**5.48**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.90	44.64	0.942	1.135	1.073	**-5.04**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.03497		
Station	Rivermines Quarry	Intercept (Qa)	-0.00227		
Sampler	#1 PM10	Temperature	21.8 °C	295.0	°K
Flow Controller	P4601	Station Pressure	30.08 "Hg	764.0	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.10	1.059	25.40	47.44	0.938	1.102	**4.06**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
25.30	47.25	0.938	1.102	1.057	**-6.46**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Wood Street	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	21.8 °C 295.0 °K
Flow Controller	P4507	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.076	25.30	47.25	0.938	1.122	**4.28**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
25.00	46.69	0.939	1.123	1.075	**-4.87**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.03497		
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227		
Sampler	#2 PM10	Temperature	27.4 °C	300.6	°K
Flow Controller	P1018	Station Pressure	30.07 "Hg	763.8	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.40	1.120	24.00	44.82	0.941	1.157	**3.30**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.10	45.01	0.941	1.157	1.119	**-0.97**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood School	Intercept (Qa)	-0.00227
Sampler	#3 PM10	Temperature	27.4 °C / 300.6 °K
Flow Controller	P6071	Station Pressure	30.07 "Hg / 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.40	1.120	24.40	45.57	0.940	1.166	**4.11**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.40	45.57	0.940	1.166	1.118	**-1.06**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.03497		
Station	Leadwood South	Intercept (Qa)	-0.00227		
Sampler	#1 PM10	Temperature	25.5 °C	298.7	°K
Flow Controller	P1500	Station Pressure	30.07 "Hg	763.8	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.164	23.10	43.14	0.944	1.156	**-0.69**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.156	1.164	**3.01**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Lead/TSP Sampler's Flow Rate Verifications

INQUEST
Environmental, Inc.

Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 Primary TSP	Temperature	20.0 °C / 293.2 °K
Flow Controller	P4557	Station Pressure	30.11 "Hg / 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.168	23.20	43.35	0.943	1.225	**4.88**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.40	43.72	0.943	1.225	**1.165**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 QA TSP	Temperature	20.0 °C 293.2 °K
Flow Controller	P4558	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.75	1.161	22.00	41.10	0.946	1.222	**5.25**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.20	41.48	0.946	1.222	**1.158**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	20.3 °C 293.5 °K
Flow Controller	P2939	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
4.00	1.199	22.50	42.04	0.945	1.224	**2.09**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.50	42.04	0.945	1.224	**1.198**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	21.4 °C / 294.6 °K
Flow Controller	P6792	Station Pressure	30.10 "Hg / 764.5 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.156	22.80	42.60	0.944	1.222	**5.71**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.20	41.48	0.946	1.225	**1.155**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National Crane Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	21.4 °C 294.6 °K
Flow Controller	P4474	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.156	23.20	43.35	0.943	1.211	**4.76**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.10	43.16	0.944	1.212	**1.154**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Water Plant	Intercept (Qa)	-0.00227
Sampler	#3 TSP	Temperature	21.8 °C 295.0 °K
Flow Controller	P4475	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.90	1.188	22.10	41.29	0.946	1.221	**2.78**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.40	41.85	0.945	1.220	**1.186**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

INQUEST
Environmental, Inc.

Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Quarry	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	21.8 °C 295.0 °K
Flow Controller	P2940	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.65	1.149	23.50	43.91	0.943	1.222	**6.35**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.221	**1.143**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Wood Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	21.8 °C 295.0 °K
Flow Controller	P2941	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.157	22.90	42.78	0.944	1.226	**5.96**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.90	42.78	0.944	1.226	**1.153**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
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Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	27.4 °C 300.6 °K
Flow Controller	P4476	Station Pressure	30.07 "Hg 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.184	22.10	41.29	0.946	1.233	**4.14**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.40	41.85	0.945	1.232	**1.181**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
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Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood School	Intercept (Qa)	-0.00227
Sampler	#3 TSP	Temperature	27.4 °C / 300.6 °K
Flow Controller	P6793	Station Pressure	30.07 "Hg / 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.168	22.60	42.22	0.945	1.230	**5.31**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.70	42.41	0.944	1.228	**1.163**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

INQUEST
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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood South	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	25.5 °C 298.7 °K
Flow Controller	P4559	Station Pressure	30.07 "Hg 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.164	23.10	43.16	0.943	1.242	**6.70**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.00	42.97	0.944	1.244	**1.161**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Calibration Orifice Certification Worksheet

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 09, 2014 Rootsmeter S/N 0438320 Ta (K) - 292
Operator Tisch Orifice I.D. - 1882 Pa (mm) - 759.46

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3530	4.1	1.50
2	NA	NA	1.00	1.0430	6.8	2.50
3	NA	NA	1.00	0.9510	8.1	3.00
4	NA	NA	1.00	0.8790	9.5	3.50
5	NA	NA	1.00	0.6660	16.3	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0143	0.7496	1.2368		0.9945	0.7350	0.7594
1.0106	0.9690	1.5967		0.9910	0.9501	0.9804
1.0089	1.0608	1.7491		0.9893	1.0402	1.0740
1.0070	1.1456	1.8893		0.9874	1.1233	1.1600
0.9978	1.4983	2.4736		0.9784	1.4691	1.5188
Qstd slope (m) =		1.65282		Qa slope (m) =		1.03497
intercept (b) =		-0.00370		intercept (b) =		-0.00227
coefficient (r) =		0.99999		coefficient (r) =		0.99999
y axis = SQRT[H2O(Pa/760)(298/Ta)]				y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}